PRELIMINARY ENVIRONMENTAL IMPACT ANALYSIS OF DESERT LAND ENTRY LANDS IN CHRISTMAS VALLEY, OREGON

by

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PRELIMINARY ENVIRONMENTAL IMPACT ANALYSIS OF DESERT LAND ENTRY LANDS IN CHRISTMAS VALLEY, OREGON

ABSTRACT: The Bureau of Land Management's Lakeview District is currently under pressure to allow 16,000 acres located throughout the Christmas Lake Administrative Unit to be appropriated through the Desert Land Entries Act of 1877. These appropriations are being filed for by persons wishing to consolidate small public and private land tracts into irrigable units for the purpose of increasing their alfalfa hay production. Preliminary environmental analyses have shown that archeological and groundwater resources are the major limiting factors to the appropriations of these lands. Archeology studies, within the Christmas Lake Administrative unit, show that one major archeological site exists every nine acres. Major sites are defined as campgrounds, seasonal villages, middens (refuse piles), or tool manufacturing sites and exclude isolated finds of arrowheads, spearpoints, scrapers, or obsidian chips. Loss of the archeological resources contained within the administrative unit can be minimized but would require extensive research and the collecting and cataloguing of all material found at major sites.

The quality and quantity of groundwater available for use by irrigation systems has not been fully determined yet. Brackish groundwater containing baron concentrations potentially toxic to

alfalfa have been located in localized perched groundwater pockets with the Christmas Valley. This, coupled with the uncertain relationships of the Christmas Valley groundwater supply to groundwater supplies of neighboring basins, presents the major environmental considerations needing to be defined before approval of lands acquisition is to proceed.

INTRODUCTION

Agricultural development of the Christmas Valley area started in the homesteading era of the 1900's. Without adequate irrigation technology, however, cash crop agriculture was not feasible. At the start of World War I, most of the farmers simply abandoned their places and went to work in shipyards, sawmills, and other needed industries.[1] The abandoned lands were bought by several of the large livestock operations in the area, primarily the ZX Ranch, headquartered in Paisley, and used by these ranches for livestock grazing.

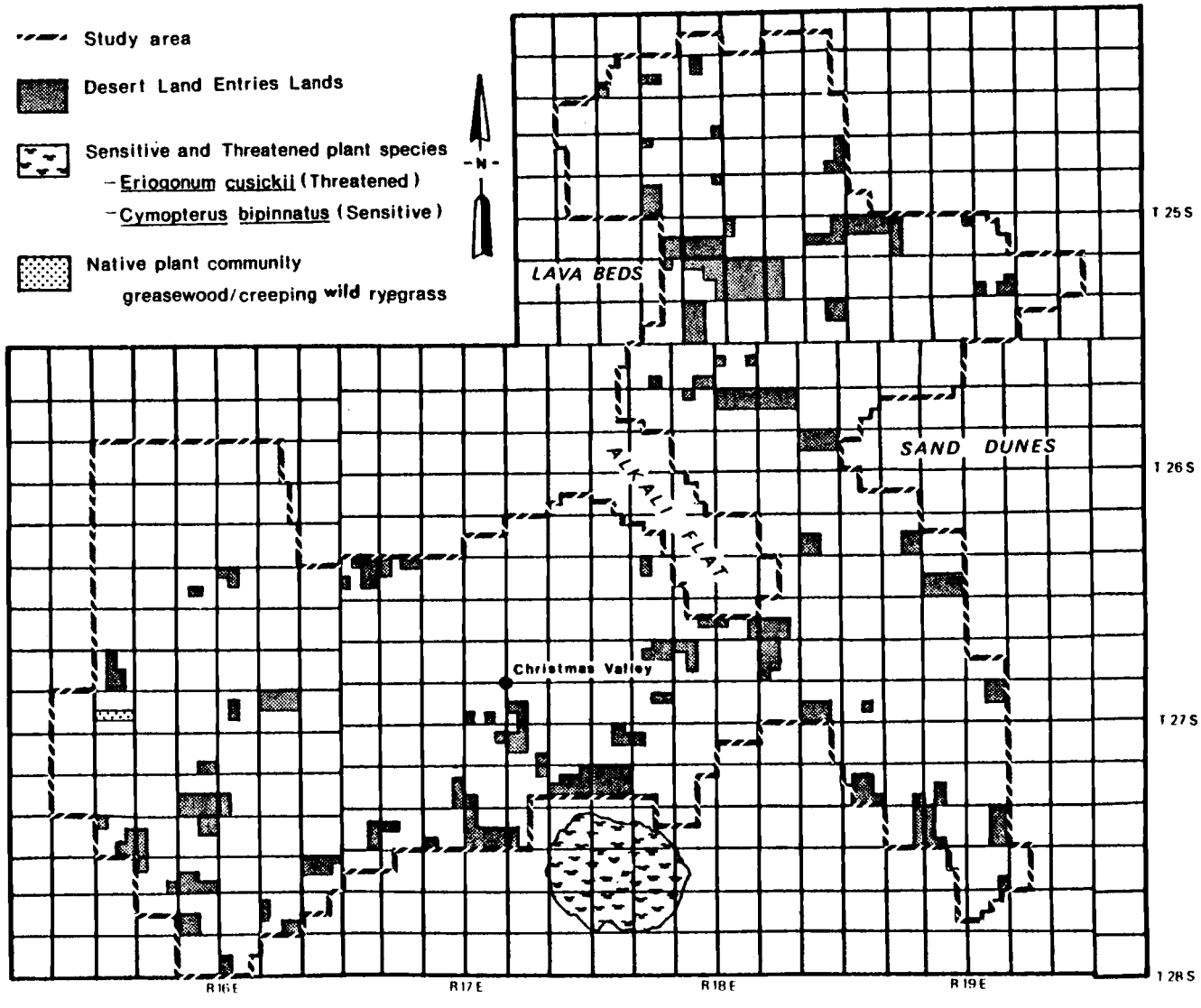
The situation remained the same until about 1960 when the M. Penn Phillips Land Company bought most of the ZX land in Christmas Valley for subdivision into 10-20 acre tracts for resort and retirement use.[2] By 1965, Phillips had established the townsite of Christmas Valley with the original development containing a lodge with a dining room, nine hole golf course, artificial lake, riding stable and rodeo grounds, church, general store, two service stations, two

real estate offices, two motels, and a piped domestic water system. Approximately 2,700 lots were surveyed and sold at the time of the original subdivision, and many have been resold a number of times. Of the original subdivision only 20 lots have permanent type structures at this time.[3]

The recent settlement trend began in about 1975, and has been characterized by heavy capital investment in irrigation agriculture, primarily for alfalfa hay production.[4] This investment in irrigation agriculture has sparked considerable interest in acquiring subdivided lands for the purpose of combining these small parcels into larger sized units which can be economically irrigated.

The Bureau of Land Management (BLM), Lakeview District, administers approximately 16,000 acres of unclassified public land which is eligible for acquisition by private individuals (Figure 1). Applications for ownership of these lands have recently been made by private citizens under the Desert Land Entries Act of 1877. The intended purpose of these entries is to consolidate small tracts of public and private rangeland into tracts large enough for center pivot irrigation systems. The objective of this paper is to identify and define the possible environmental impacts and constraints of the lands acquired through Desert Land Entries.

Figure 1 - Christmas Lake Administrative Unit



Scale: one inch equals four miles

DESCRIPTION OF PROJECT

Currently, there are 141,500 acres of private land in the Christmas Valley area, of which 67,000 are subdivided into parcels too small for center pivot irrigation development. Of the remaining 74,500 acres, approximately 50,000 had been developed for irrigation agriculture by 1981.[5] On the 16,000 acres of public land, only 640 acres are in an authorized grazing lot. The balance is in largely isolated tracts that are unfenced, where livestock grazing is unauthorized, thus creating management difficulties and inefficient use of these public lands by the BLM. These isolated tracts are trespassed on by private landholders who have illegally incorporated public land into their operations, and by both power and telephone utility lines which cross them with no legal right-of-ways.

In an attempt to consolidate lands in the Christmas Valley area, private individuals have made applications to acquire public lands through the Desert Land Entries Act. The act of March 3, 1877, (19 Stat. 377;43 U.S.C. 321-323) as amended by the act of March 3, 1891, (26 Stat. 1096; 43 U.S.C. 321, 323, 325, 327-329) states:[6]

> [the act] Provides for making of desert land entries in the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. It is the purpose of the statutes governing desert land entries to encourage and promote the reclamation, by irrigation, of the arid and semiarid public lands of the Western States through individual effort and private capital, it being assumed that settlement and occupation will naturally follow when the lands have thus been rendered more productive and habitable.

Regulations pertaining to the disposition, occupancy and use of Desert Land Entries are outlined in the U. S. Department of the Interior, Bureau of Land Management circular number 2291 and includes the following provisions: lands subject to disposal must be irrigable, surveyed, unappropriated, and nonmineral; the quantity of land which may be claimed is 320 acreas; any citizens of the United States, 21 years of age or older, or any person of that age who has declared his intention of becoming a citizen can make a desert land entry; no desert land entry application will be allowed unless accomplished by evidence satisfactorily showing that the entryman has already acquired the permanent use of sufficient water to irrigate and reclaim all of the irrigable portion of the land sought.

Fees paid for desert land entry consist of a $15 application fee plus .25 per acre at the time of the initial filing. At the time of making final proof, the claimant must pay to the BLM area manager the sum of $1 per acre for each acre of land upon which proof is made. To fulfill the requirements of the final proof the entryman is allowed four years from the date of entry within which to comply with the requirements of the law as to reclamation and cultivation of the land and to submit final proof. Final proof may be made and patent thereon issued as soon as there has been expended the sum of $3 per acre in improving, reclaiming, and irrigating the land; one-eighth of the entire area entered has been properly cultivated and irrigated; and when the requirements of the desert land laws as to water rights

and the construction of the necessary reservoirs, ditches, dams, and wells have been fulfilled. After final proof and payment have been made, the land may be sold and conveyed to another person without the approval of the Bureau of Land Management.

Between 1976 and 1980, the Bureau of Land Management processed 86 applications for a total of 14,839 acres and have finally accepted 42 applications for 8,839 acres.[7] To date, none of these parcels has been transferred to private ownership.

In Jackson's survey of local residents, county, state, and federal resources agency personnel, the factors contributing to the increase in agricultural development were cited as availability of ground water for irrigation, favorable government development loan programs, inexpensive land, and the recent favorable market for alfalfa produced in the area.[8] The Desert Land Entries act provides access to the inexpensive land aiding in the agricultural development of the area. However, Gesity cites the BLM's concern for the potential impacts stemming from the transfer of public lands to private ownership for agricultural development as: "suitability of the soil to grow agricultural crops, loss of cultural resources, loss of botanical resources, loss of mineral resources, and the possible over obligation of water to irrigation croplands which would cause water to be used faster than it could be replace."[9]

DESCRIPTION OF CURRENT ENVIRONMENTAL SETTING

Christmas Valley lies within the Christmas Lake Administrative Unit, which is located within an interstate geomorphological area called the Great Basin. The Great Basin is commonly defined as the geographic area bounded on the west by the Sierra Mountains, on the south by the Mohave Desert, on the east by the Colorado Plateau and on the north by the Columbia Plateau. The extreme northern edge of the administrative unit may be considered by some scientists to be in the Columbia Plateau Region because the boundaries between the major geomorphological areas are not precisely defined. However, the area in question for this analysis will be considered as being within the Great Basin geomorphological area. Regionally, the northern portion of the Great Basin lying within Oregon is called the Basin and Range Province, and is referred to locally as the "High Desert."

Within Christmas Valley, the ecological zones according to the classification system used by the Bureau of Land Management are Sagebrush, Saltshrub, Small Lakebeds, Grass Seedings, and Cropland (Table 1). The primary criterion for these designations were vegetative type, with some zones being identified by other large-scale ecological influences such as cropland.[10] Grass seedings on non-irrigated rangelands were identified as a zone because of their monotype influence on native fauna and their use in intensive livestock management.

TABLE 1 - ECOLOGICAL ZONES[11]

	PHYSICAL CHARACTERISTICS		BIOLOGICAL CHARACTERISTICS	
Ecological Zone	Relief	Soils	Major Vegetation in Zones	Major Animals in Zones
Sagebrush	0-20% slope in rolling foothils, with over 40% slope in broken uplands.	Ardisols of uplands. Shallow stony, and light colored with clayey or loamy subsoils. Wind and water erosion when vegetation is removed.	Big, low and black sagebrush with scattering of Rabbitbrush. Bunchgrass and forb understory.	Mule deer, antelope, upland game birds, songbirds, raptors, small mammals & small reptiles. Water fowl at permanent fresh water sites.
Rabbitbrush	0-20% slope. Flat to slightly rolling valley bottoms.	Aridisols of cool or cold basins. Ranging from sand or gravel to clay. Light colored, neutral or calcareous. Many poorly drained and salt affected with shallow hardpans. Wind erosive.	Gray and green rabbitbrush with an understory of scattered bunchgrass, forbs and annuals.	Same as above, but not as high in number or variety.
Salt Shrub	Usually less than 5% slope. Generally flat to slightly rolling.	Same as above.	Shadscale, greasewood and spiny hopsage overstory with scattered perennial grasses and forbs understory. This grades into saltgrass areas around lakes, springs and seeps.	Large mammals other than wild horses and domestic livestock uncommon. Songbirds, shorebirds, small mammals, and small reptiles present. Water fowl at springs and seeps.
Small Lakebeds	Flat	Aridisols of uplands. Moderately deep, light colored clayey soil. Wind erosive.	Varying from barren to a sparse cover of annuals to being covered with a uniform stand of silver sagebrush.	Antelope, sage grouse, a few water fowl, song birds, small mammals and reptiles, wild horses and domestic livestock.
Grass Seedlings	0-30% slope. Flat to rolling.	Same as the sagebrush and Rabbitbrush zone.	Predominantly crested wheatgrass with a domestic mix of sandfoil, alfalfa, sweet clover, and birdsfoot-treefoil.	Mule deer, antelope, sagegrouse, a few song birds, small mammals and reptiles. Domestic livestock.
Cropland	0-10% slope. Flat to rolling.	Aridisols modified by irrigation.	Agricultural crops of alfalfa, rye, pasture grass, sometimes irrigated and fertilized native grasses.	Mule deer, antelope, a few songbirds, few small mammals and reptiles, and reptors.

Precipitation in the area averages about 11 inches per year, with annual extremes varying as much as 10 inches. Most precipitation occurs during the winter months and short-term droughts are common. The January mean minimum temperature ranges from 9 to -11°C, and the July mean maximum temperature ranges from 29 to 31°C, with an average of 80 frost free days per year. Winds are predominantly from the southwest, with occasionally cold north winds throughout the year.[12]

ENVIRONMENTAL IMPACTS AND CONSTRAINTS

Historic and Archeologic Resources

The most significant series of cave sites in the northern Great Basin are found in south-central Oregon.[13] These sites are located in the Fort Rock Basin, which includes Fort Rock Valley, Christmas Valley, Silver Lake, and Paulina Marsh. The Fort Rock Caves, Cougar Mountain Caves, and Connley Caves, all major sites, are located on the former shoreline of pleistocene Fort Rock Lake, which covered most of this basin until about 13,000 years ago. According to radiocarbon dates from these caves, this area has been a site of human occupance since at least that time.[14]

The first excavations carried out in the Fort Rock Basin were at Fort Rock Caves in 1938. A variety of artifacts were recovered, including the remains of 75 to 100 sagebrush bark sandals which were

found beneath an undisturbed layer of volcnic ash. Analysis of the volcanic ash indicated that it was ejected by the eruption of Mount Mazama at the present location of Crater Lake. Radiocarbon dating was used to estimate this eruption at about 5,000 B.C.[15] Other artifacts assembled from this period include unstemmed and unnotched projectile points, scrapers, gravers, a mano, and flakes exhibiting wear. Toepel, Minor, and Willingham in their report, Human Adaptation in the Fort Rock Basin; A Class II Cultural Resources Inventory of Bureau of Land Management Lands in Christmas Lake Valley and South-Central Oregon, have compiled a complete record of the artifacts and estimates of age from the Cougar Mountain and Connley Caves, which have a similar history as the Fort Rock Caves.

During the summer of 1976, archeologists from the University of Oregon, under contract with the Bonneville Power Administration, conducted an archeological survey along the route of the Celilo-Sylmar Transmission Line.[16] This survey passed through the Fort Rock/Christmas Lake Basin and recorded 2 sites located in the Fossil Lake/Mount Springs area. Both sites were projectile and utensil production sites known as lithic workshops. A follow-up study involving test excavations at sites to be impacted by construction of the transmission line was conducted by archeologists from Oregon State University. The report on these excavations has not yet been completed.

In 1977, an archeological survey of selected areas of Christmas Valley was conducted by employees of the Bureau of Land Manage-

ment.[17] The purpose of the survey was to identify and evaluate archeological sites within areas considered for appropriation. In all, 22 sites were recorded, including large open middens, lithic workshops, and flake scatters of varying densities. Toepel, Minor, and Willingham conducted an archeological inventory by randomly selecting eight study plots of eighteen square miles a piece (Figure 2). One and one-half percent of each study area was inventoried and 102 sites consisting of campsites, lithic workshops, middens, and seasonal villages, and 977 isolated finds of lithic scatters, projectile points, and scrapers were located. The authors concluded that the Christmas Lake Valley contains one site (workshop, campsite, etc., not isolated finds such as single projectile points) per nine acreas.[19]

The problems and constraints imposed by the vast amount of archeological artifacts existing within the lands designated for disposal through Desert Land Entries imposes, mainly, as administrative concern to the Bureau of Land Management. The laws and regulations that affect historic, cultural, and archeological resources are listed in Table 2. The principal laws are the Antiquities Act of 1906, Historic Preservation Act of 1966, Historic and Archaeological Data Preservation Act of 1974, and the Archaeological Resources Protection Act of 1979.[21] The process that the BLM uses in evaluating archeological sites within Christmas Valley for compliance with federal and state requirements is summarized in Figure 3. Utilizing

Figure 2 - Fort Rock Basin Archaeological Sites[18]

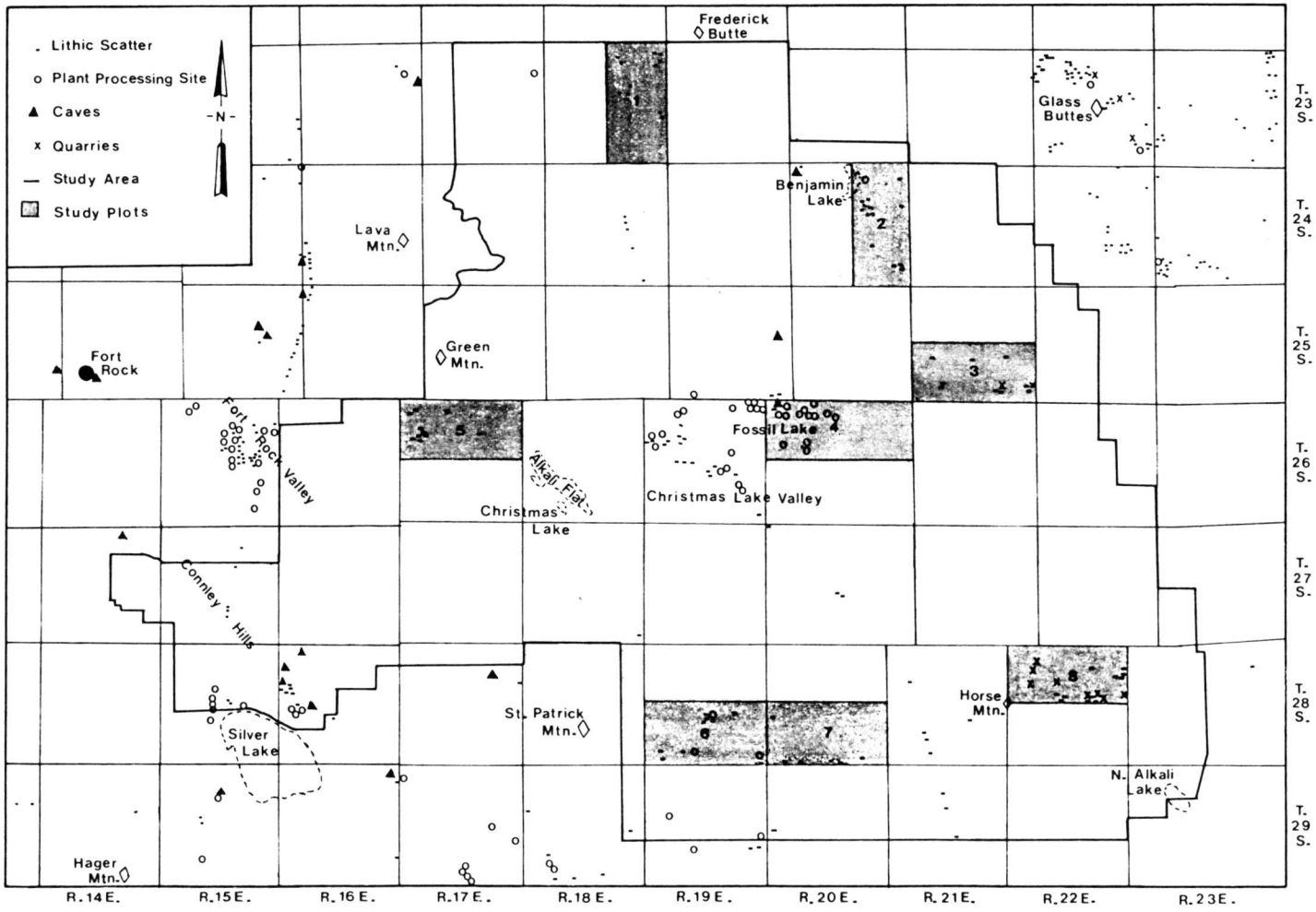
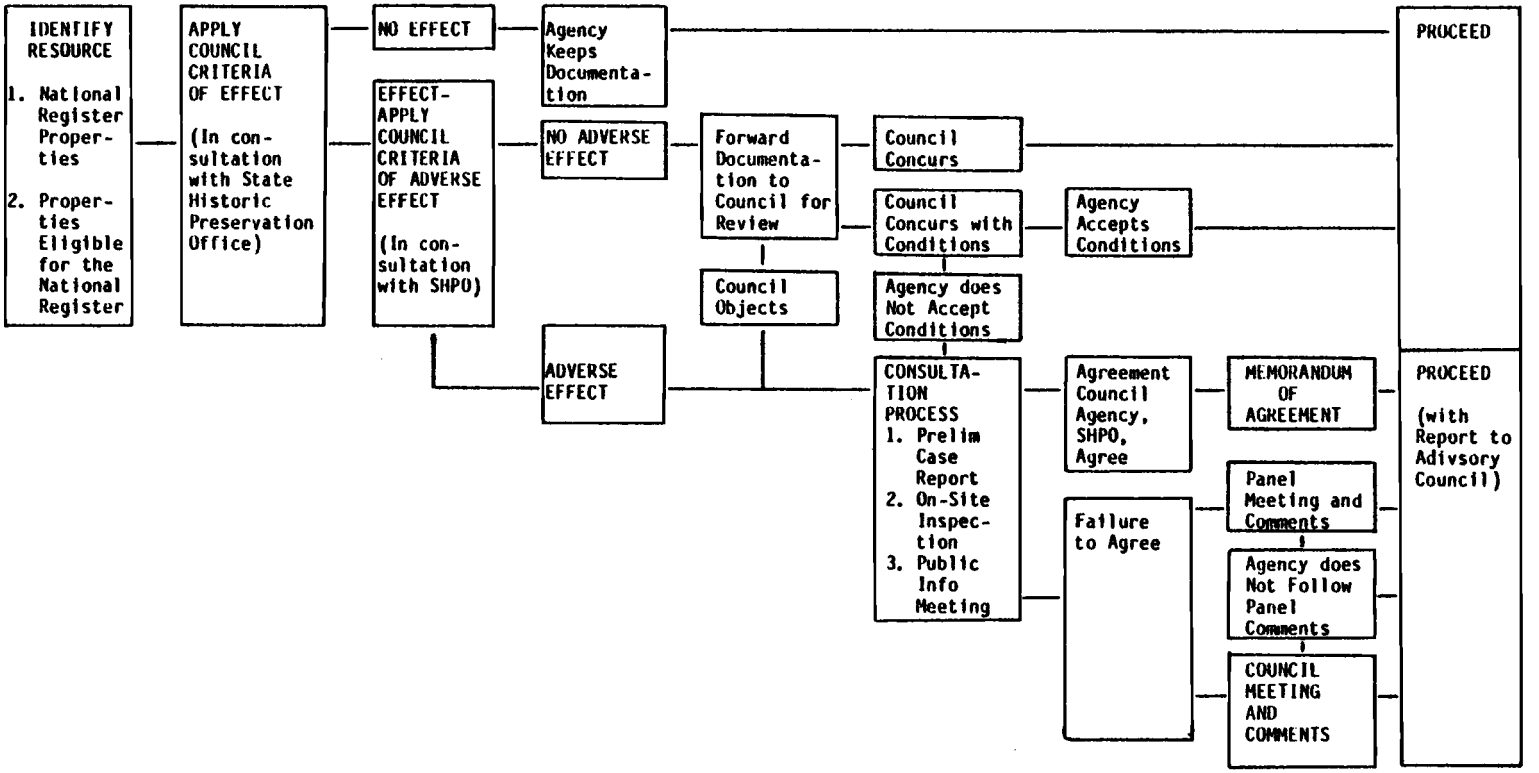


TABLE 2 - LAWS AND REGULATIONS GOVERNING HISTORIC AND CULTURAL RESOURCES[20]

Date	Law Number	CFE Number	Title
1906			ANTIQUITIES ACT OF 1906
1935	PL 94-292		PRESERVATION ACT OF 1935
1960	PL 86-523		RESERVOIR SALVAGE ACT
1966	PL 89-665		HISTORIC PRESERVATION ACT OF 1966
1969	PL 91-190		NATIONAL ENVIORNMENTAL POLICY ACT OF 1969
1970	EO 11514		PROTECTION & ENHANCEMENT OF ENVIORNMENTAL QUALITY
1971	EO 11593		PROTECTION & ENHANCEMENT OF THE CULTURAL ENVIRONMENT
1973		40 CFR 1500	PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS
1974		36 CFR 800	PROCEDURES FOR THE PROTECTION OF HISTORICAL AND CULTURAL PROPERTIES
1974	PL 93-291		HISTORIC AND ARCHEOLOGICAL DATA PRESERVATION ACT
1975			PROTECTION OF PROPER;TIES ON THE NATION REGISTER; PROCEDURES COMPLIANCE
1976		36 CFR 63/1204	PROCEDURES FOR REQUESTING DETERMINATIONS OF ELIGIBILITY
1976			MULTIPLE RESOURCE NOMINATIONS
1976			TOM KING-ARCHEOLOGICAL PROPERTY NOMINATIONS
1976			NONAQUEOUS BURIAL OF SITES
1977		36 CFR 60/61 1201	CRITERIA FOR COMPREHENSIVE STATEWIDE HISTORIC SURVEYS & PLANS
1977			THEMATIC GROUP NOMINATIONS
1977			MULTIPLE RESOURCE NOMINATIONS
1977		36 CFR 64	CRITERIA & PROCEDURES FOR THE IDENTIFICATION OF HISTORIC RESOURCES
1977		36 CFR 66/1210	RECOVERY OF SCIENTIFIC, PREHISTORIC, HISTORIC, & ARCHEOLOGICAL DATA: METHODS, STANDARDS, AND REPORTING REQUIREMENTS
1978		36 CRF 3	DEFINITION OF OBJECT OF ANTIQUITY
1978	PL 95-341		AMERICAN INDIAN RELIGIOUS FREEDOM
1979	PL 96-95		ARCHEOLOGICAL RESOURCES PROTECTION ACT OF 1979
1979		36 CFR 800	PROTECTION OF HISTORIC AND CULTURAL PROPERTIES
1980	PL 96-515		NATIONAL HISTORIC PRESERVATION AMENDMENTS OF 1980
1980			EXECUTIVE DIRECTORS PROCEDURES FOR REVIEW OF PROPOSALS FOR TREATMENT OF ARCHEOLOGICAL PROPERTIES: SUPPLEMENTARY GUIDANCE
1980		36 CFR 1020	OWNER NOTIFICATION

FIGURE 3 - BUREAU OF LAND MANAGEMENT FLOW DIAGRAM[22]



this procedure and the Archeological Data Preservation Act of 1974 and the Archeological Resources Protection Act of 1979, the BLM eliminates the problem of site preservation by conducting inventories of the lands to be disposed of and by collecting, cataloguing and storing the archeological artifacts it uncovers. Once the inventory has been completed, the lands are open for disposal. This may be an acceptable process for small, individual tracts of land to be disposed of, but because 100% of the land does not have to be inventoried and 16,000 acres are proposed for disposal, the cumulative impact could be a loss of approximately 900 archeological sites and thousands of isolated artifacts.

Historic sites located within the Christmas Lake Administrative unit are the Jacksonville/Boise Wagon Road, the Yreka Trail, and the Rude Long Cabin, but these are not located in the areas considered for desert land entries and would not be affected by the sale of these lands.

Natural, Ecological, and Scientific Resources

The Christmas Lake Administrative unit contains many acres of natural, ecological, and scientific resources, such as the Lost Forest, Crack-In-The Ground, active sand dunes, forest/rangeland ecological transition zones, and lava tablelands. The Lost Forest was withdrawn from all forms of appropriation under the public land laws, and reserved for scientific, instructional, and research study

purposes as the Lost Forest Research Natural Area.[23] None of the above mentioned natural, ecological or scientific areas lie within the area of unclassified lands open for appropriation. However, one native plant community of Sarcobatus spp. (greasewood)/Elymus triticcides (creeping wild rye) exists within the appropriation area and is being considered for preservation (Figure 1).[24] This stand, located on the west edge of the area is considered by Depoali to be one of the best examples of this plant community within the Christmas Lake Administrative Unit.

Vegetation and Soils

The existing vegetation zones and their associated soils were previously described (Table 1). Aridisols soil predominate throughout Christmas Valley. Aridisol soils are dry throughout most of the year, and with the existing vegetation being sparse, the soils are susceptible to wind erosion. Due to the climatic conditions associated with Aridisols, they are generally light in color, low in organic matter, and may have a norizon of accumulation of calcium carbonate, gypsum, or salts which are manifested as hardpans in certain areas of the valley.[25]

Preliminary investigations show that these soils are favorable for irrigation agricultural development. The Bureau of Land Management's class II soil survey indicates that under irrigation, Aridisols become more stable to wind and water erosion due to the

increased groundcover. It has been found that with irrigation the soil horizons develop to a deeper depth and hardpans break and dissolve, thus allowing expansion of the root zone for crop growth. Brady states, "Where irrigation water is available Aridisols can be made most productive; irrigated valleys of the western United States are among the most productive in the country."[26]

Due to the ease at which Aridisols are eroded by wind under sparce vegetation conditions, concern has been raised about wind erosion problems developing within Christmas Valley if irrigation should cease. If the stoppage of irrigation does cause an acceleration of wind erosion, the active sand dunes, located on the east end of the valley, may increase their activity, thus tipping the balance existing between the sand dunes of the Lost Forest in favor of the dunes and to the detriment of the forst. This could cause an irreversible loss of the Lost Forest.

The predominant ecological zones existing on the lands classified for exchange are Artemisia sp. (Safebrush sp.) and Chrysothamnus sp. (Rabbitbrush sp.). Preliminary inventories have located no sensitive, threatened or endangered species of plants within the study area, however Eiogonum cusickii (Cusick's Esiogonum), a threatened species, and Cymoptesus hipinnatus (Hayden's Cymopteus) a sensitive species have been located on the southern fringe of the study area (Figure 1).[27]

Wildlife

Wildlife utilizing the different ecological zones were summarized in Table 1. The only special notation is that the American Bald Eagle has been seen hunting the cropland areas for the small mammals that occupy that ecological zone.[28] There is no critical habitate, including winter ranges, located within the exchange lands. Therefore no indirect, cumulative, or irreversible impacts would be imposed on wildlife of the area if land sales did occur.

Surface and Subsurface Water Resources

The Fort Rock Basin and adjacent uplands are within the Great Basin section of the Basin and Range physiographic province. The landforms of the Fort Rock Basin fall into two categories--those associated with the basin floor and those associated with the mountain uplands. The area of unclassified public lands that the BLM is considering for appropriation by desert land entries is entirely located within the basin floor, but to understand the basin's surface and subsurface water dynamics, the entire basin must be studied.

The basin floor has an altitude of about 4,300 feet, and the mountainous parts of the drainage basin rise to altitudes of about 5,900 feet; thus the maximum local relief within the area is about 1,600 feet. The surface drainage of the basin is internal, only three streams--Buch, Silver, and Bridge Creeks--are perennial. The channels of the other creeks in the uplands are dry most of the year.

Topographic features on the plains of the basin are the result of four main processes; water deposition, wave action, wind action, and volcanism.[29] The volcanic features are the most apparent because the local relief due to water, wave, and wind action exceeds 50 feet. In contast, eroded cinder cones and volcanic plugs rise as much as 200 feet above the general basin floor.

The most striking topographic features of the mountain uplands that surround the basin are high fault scarps, block mountains, volcanic shields and cones, and the slopes and surface features of the lava.[30] Some examples of block mountains and fault scarps occur along the southern border of the basin separating this basin from the adjacent Summer Lake basin to the south and along both the eastern and western borders. Gently sloping lava plains and lava shields, as well as cinder and lava cones, form the uplands to the north and northwest of the basin. The Connley Hills formed by Horning Bend and Hayes Butte, which are respectively an eroded lava cone and a composite lava shield, rise in the south-central part of the basin.[31]

The general description and relationship of rock units within the basin were described by Hampton as follows:

> The rock units of the Fort Rock Basin range in age from Pliocene to Recent and, from oldest to youngest, are; Picture Rock Basalt, volcanic rocks of intermediate composition, Fort Rock formation, Hayes Butte Basalt, Peyeri Tuff, Paulina Basalt, unconsolidated deposits, and younger basalts. Some of these rock units intertongued and are in part equivalent in age, but are readily distinguishable on the basis of lithology.[32]

Hampton subdivided the Fort Rock Basin into eight separate subareas of principal groundwater units. The unit of concern with respect to the desert land entries is the Fort Rock-Christmas Lake Valley Unit. This is the largest subarea in the Fort Rock Basin, and is a flat nearly featureless plain, extending eastward about 40 miles from Fort Rock, and ranging in width from 4 to about 12 miles. The two principal aquifers in this subarea are the Paulina Basalt, which at places underlies and elsewhere forms the northern border of the subarea, and the Fort Rock formation, which underlies the greatest part of the area with the Picture Rock Basalt underlying the area at depth.[33] Well yields are commonly large with low to moderate drawdown. Water quality is generally suitable for irrigation and below 1,000 ppm total dissolved solids. Hardness of the water ranged from 44 to 277 ppm, chloride content from 1.0 to 121 ppm, and dissolved solids from 128 to 729 ppm.[34] More saline or brackish water does exist within the basin in perched groundwater tables that are caused by localized hardpans. These brackish waters have been reported to contain boron in concentrations of up to 3 ppm.[35] That amount is considered unsuitable for plants that are sensitive to boron and may be harmful to some semitolerant crops, such as small grains and potatoes.[36] This is of concern for the development of the basin, but it is believe that the development of irrigated agriculture will, in itself, mitigate the problem. The treatment for brackish water located on hardpans is irrigation or flooding, which dissolves and

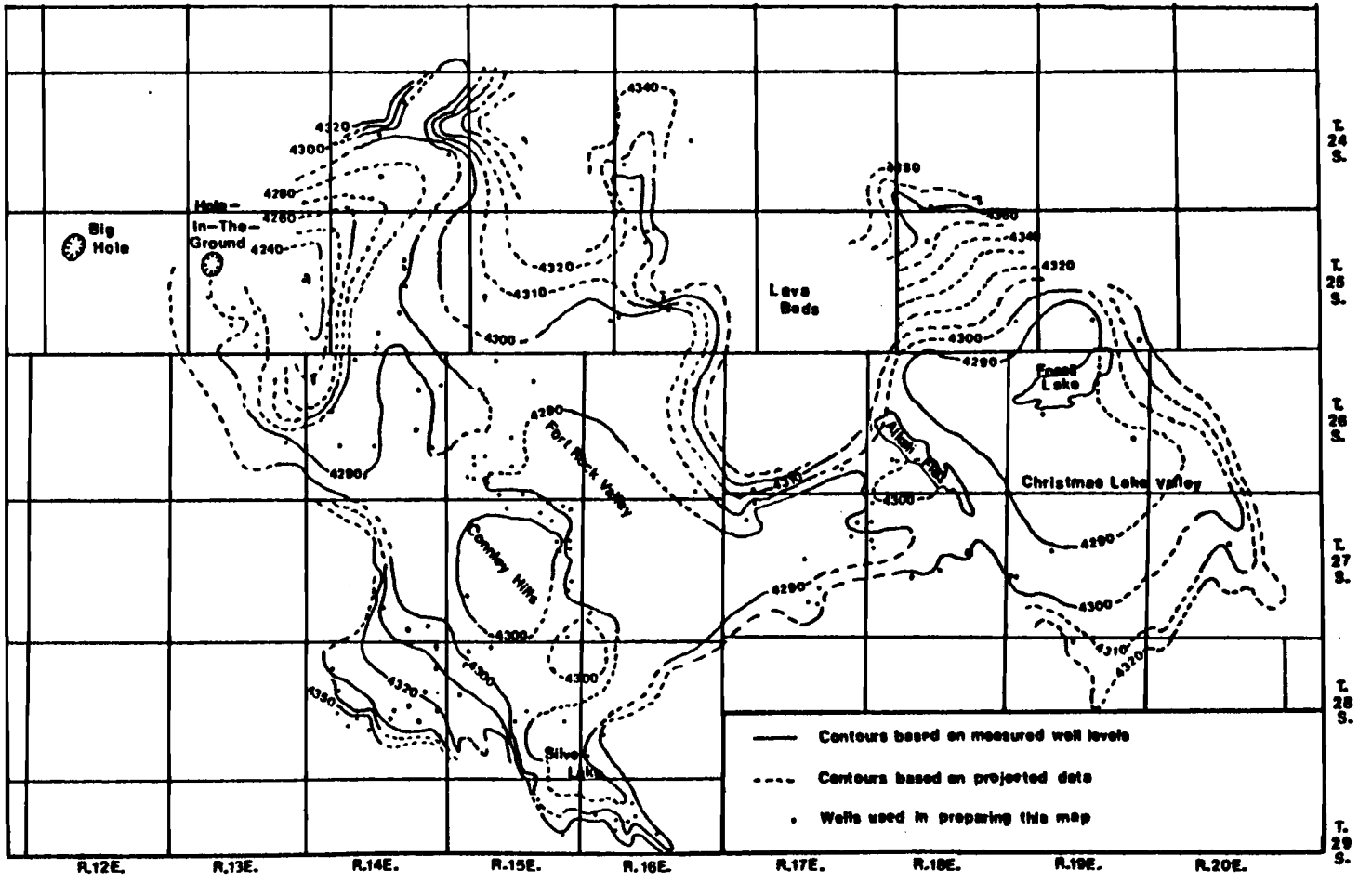
breaks up the hardpan which allows further percolation and thus purification of the groundwater.[37]

The potentiometric map by Travger aids in showing the important of understanding the groundwater flow system of the Fort Rock Basin (Figure 4).[38] Miller describes the Fort Rock Basin potentiometric conditions as follows:[40]

> The water level elevation in wells on the valley plain is essentially flat at 4290-4300 feet mean sea level. On the upland slopes adjacent to the valley plains, the gradient is about 10-15 feet per mile toward the basin interior. This indicates that recharge to the basin should occur along the entire perimeter of the valley floor. A significant subsurface drain occurs in the area of the Hole-In-The-Ground and, perhaps, at Silver Lake also. Playa, subsurface, or phrentophyte discharge may occur in the Fossil Lake area of Christmas Valley where a subtle flat, under level low occurs.

The major environmental impact question facing the BLM and their decision to proceed with granting desert land entries, is what quantity of water can be withdrawn from the groundwater reservoir annually without producing any undesirable effects. Miller presents a "rough first-round estimate" of annual recharge at 100,000 to 150,000 acre-feet per year.[41] The BLM and Jackson have accepted the figure of 125,000 acre-feet per year annual recharge.[42] Therefore, in order to maintain the annual recharge in a steady state or equilibrium with the annual withdrawal, 100,000 to 150,000 acre-feet per year could be withdrawn for irrigation. An equilibrium where annual recharge equals annual withdrawal would not be the most efficient use of the groundwater reservoir, however.[43] A more efficient use of the

Figure 4 - Potentiometric Map of the Fort Rock Basin



groundwater reservoir would be to drawdown the groundwater level to the point where none escapes through the basin drains located at Hole-In-The-Ground and the Silver Lake area. This would allow the groundwater reservoir to be managed similarily to a surface water reservoir which has drawdown during the irrigation season and recharge during the dormant season. Therefore, the water being lost to the underground drains could be used for irrigation which would provide ample supplies to meet the needs of the irrigation development.[44] However, it is believed or assumed that the groundwater draining from Hole-In-The-Ground moves either to the Summer Lake Valley or to the Deschutes River Valley, and that the leakage from the Silver Lake area may be the source of Ana Springs in the Summer Lake area.[45] If this is true, there could be disasterous and irreversible effects, especially to the wildlife area fed by Ana Springs, if the subsurface drains were closed.

Recreation, Esthetics and Visual Quality

Within the area appropriated for desert land entries, there would be little to no effect from conversions to irrigated agriculture. The two major recreational activites of the area are hunting and arrowhead collecting. Hunting may be enhanced by the added forage production utilized by antelope and mule deer. Conversely, arrowhead collecting may be limited by increased forage or groundcover and loss of public lands to private ownership, but no major

cultural resources should be lost due to the inventories that must be conducted to comply with the laws protecting them.

The visual resurces of the valley should not be significantly affected, because irrigation agriculture is replacing one low groundcover with another form of low groundcover without any major changes in the appearance and characteristics of the topography within the area.

Air Quality

There have been no quantitative studies to determine the effects of converting rangeland to irrigated agricultural lands with respect to effects on air quality. Short term qualitative reports are that wind erosion has increased, notably in the corners of converted fields with center pivot irrigation systems where the corners do not readily revegetate.[46] According to the Oregon Department of Geology and Mineral Industries, dust increased in the air when conversion of rangeland started, and has caused Oil Dry of America, a diatomaceous earth mine in Christmas Valley, to install an added air filter system to their operation.[47] Over the long term it is expected that air quality will be improved by increasing the groundcover in the area, which will stabilize areas currently susceptible to wind erosion.

SUMMARY AND CONCLUSIONS

Christmas Valley in South-Central Oregon is currently experiencing rapid growth in irrigation agriculture. To meet the demands of converting rangeland to irrigated cropland, private interests have been buying up and blocking into irrigable tracts the subdivided lots created by the M. Penn Phillips Company. Considered for additional development is 16,000 acres of unclassified public lands administered by the Lakeview District of the Bureau of Land Management. These lands have been applied for appropriations under the 1877 Desert Land Entries Act to allow them to developed to irrigated cropland.

Preliminary studies indicate that the two major concerns that need further examination are the extent of archeological resources within the area and the potential effects of reducing or eliminating the subsurface flows of groundwater out of the basin. The archeological resource problem is an administrative constraint which can be met with adequate time and manpower needed to comply with the laws and regulations protecting these resources.

The groundwater supply may be the major environmental constraint. Annual recharge has been estimated at 100,000 to 150,000 acre-feet per year. As of January 1981, 50,000 acres of private land are under irrigation, consuming 125,000 acre-feet of water.[48] Excluding the public lands, another 20,000 acres have applications for water rights pending with the Water Resource Department of

Oregon, thus posing conern for reducing the subsurface interflow between adjacent basins. Before allowing the proposed Desert Land Entries to proceed, the effects of slowing or stopping subsurface groundwater flow out of the Fort Rock Basin should be more clearly understood.

In conclusion, it would be beneficial to the Bureau of Land Management and the private interests involved to allow the Desert Land Entries to proceed, but further considerations must be given to the groundwater supply, for alterations of the groundwater resources on the Fort Rock Basin could have harmful and irreversible effects on the adjacent basins.

FOOTNOTES

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